Profile: Drowning

Hawai'i Department of Health
Injury Prevention & Control Program

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Overview of presentation

- **Fatal drownings**
  - *Comparisons w/ rest of U.S.*
  - *Local description*
    - *By environment*
- **Near drownings in Hawaii**
  - *Hospitalizations*
  - *Oahu EMS data*
    - *Limitations*
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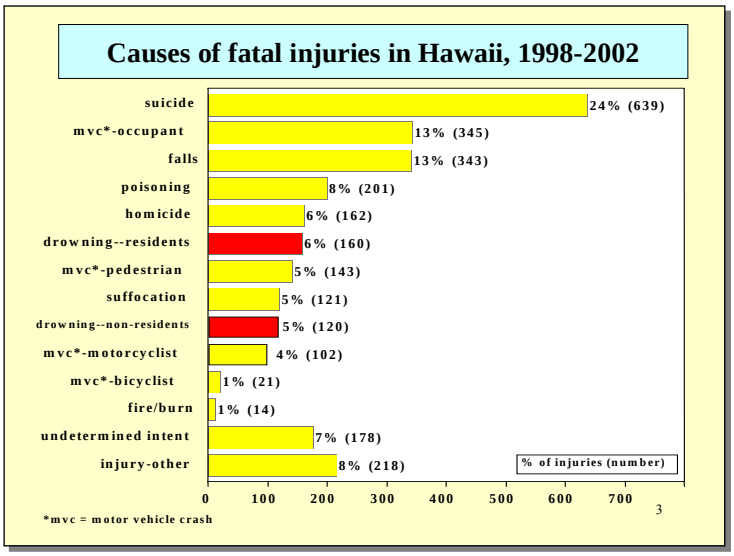
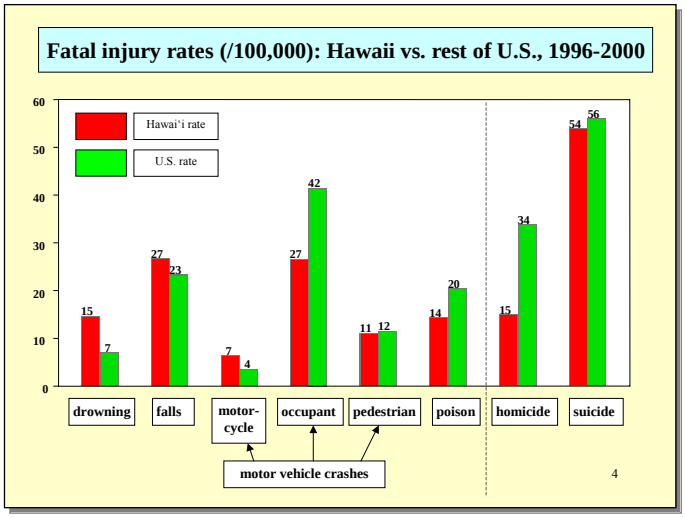
This profile addresses fatal drownings, including how drownings rank in comparison with other types of fatal injuries, and compare the drowning rates for Hawai'i to those of the rest of the U.S.

Characteristics of drownings in Hawai'i are described with an emphasis on the environment of the incident. In addition, statistics on near-drownings in Hawai'i are reviewed through hospital admission data and EMS reports for O'ahu. Data collected at 19 O'ahu beaches staffed by lifeguards are also reviewed.

The leading causes of fatal injury among Hawai'i residents from 1998 to 2002 are presented in a bar graph. Suicide was the most common cause, attributed with nearly a fourth of fatalities. Injuries to car occupants and to victims of falls were both second.



Drowning data are highlighted by red bars, distinguishing between residents and non-residents. (There were 160 resident suicide victims and 120 non-residents). Drowning was the fourth leading cause of total injury death (i.e., residents and non-residents) in Hawai‘i.



Fatal injury rates for eight selected injury areas are compared by location (i.e., Hawai'i vs. rest of U.S.). The unintentional injury categories are drowning, falls, vehicular crashes (i.e., motorcycle, occupant, and pedestrian), and poisonings. The intentional injuries are homicide and suicide.

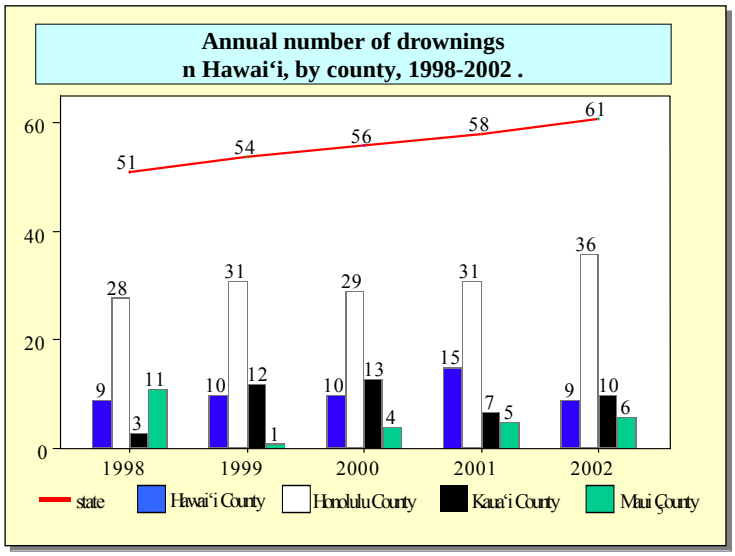
The rate of drowning[1] in Hawai‘i is high, relative to the rest of the U.S. Hawai‘i has the fifth highest drowning rate in the country. Drowning and motorcycle crash injury are the only types of injuries where the rates in Hawai‘i are significantly higher than the rates for the rest of the U.S. When the population at risk includes non-residents, the rate rises from 15 per 100,000 to 26 per 100,000.

The rate of falls is slightly higher in Hawai‘i, and the rate of fatal motorcycle crashes in Hawai‘i is almost twice that for the rest of the U.S. The higher rate of motorcycle crash fatality may be due to the clement weather in Hawai‘i which allows people to ride year-round, creating a wider window of exposure.

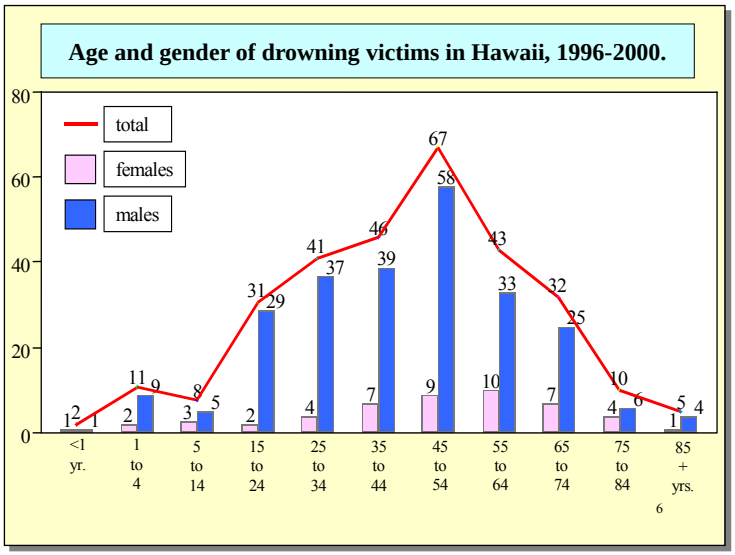
Fatality rates among car occupants are much lower in Hawai‘i compared to the U.S.; this difference accounts for most of the overall difference in unintentional injury rates. Pedestrian fatalities occur at about the same rate. The poisoning fatality rate is lower in Hawai‘i, compared to the rest of the U.S.

[1] Hawai'i residents only.

The annual numbers of drownings in Hawai‘i statewide as well as by county are presented. There was a steady increase in the number of drownings from 1998 to 2002. This pattern is most evident in the drowning data for O‘ahu[2].



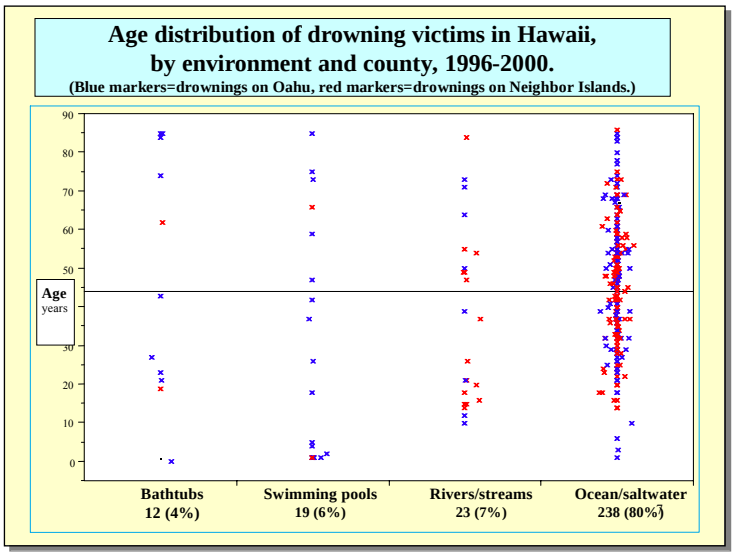
There were 280 drownings in the state, or an average of 56 per year. Slightly more than half (155, or 55%) occurred on O‘ahu. About a fifth (53, or 19%) took place on Hawai‘i, 45 (or 16%) on Kaua‘i, and 27 (or 10%) in Maui County. All but two of those in Maui County, which occurred on Moloka'i, took place on the island of Maui.



The majority (83%) of drowning victims were males, where male victims outnumbered females by more than 4-to-1. The gender ratio was narrower among the very young and very old victims.

Drownings occurred among victims of all ages, with a high peak of victims in the 25- to 64-year age range. About two-thirds (197, or 67%) of the victims were in this age range.

[2] The island of O'ahu is also known as the City & County of Honolulu.



The age distribution of drowning victims may differ, depending on the environment of the incident. Environments which pose a risk of drowning include bathtubs, buckets of water and water fountains; these were attributed with 6% of the drownings.

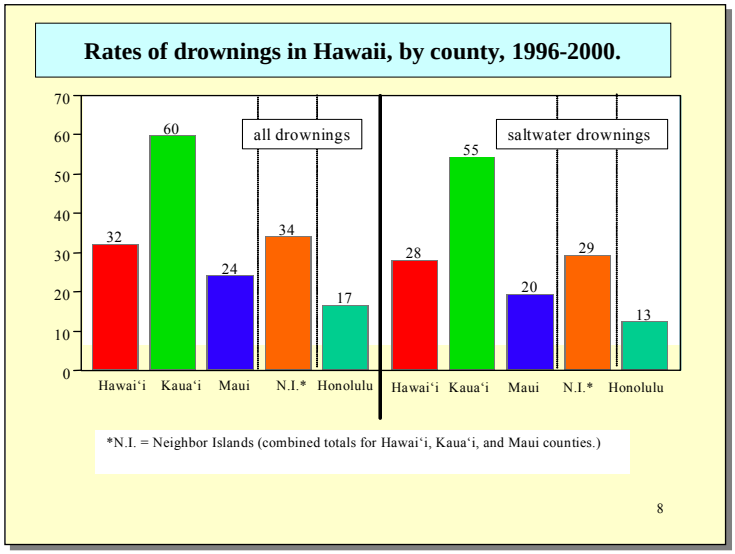
There were about equal numbers of drownings in swimming pools as in bodies of freshwater (most commonly rivers and streams). Drownings in the ocean or other saltwater environments accounted for 80% of all drownings statewide.

Of victims who drowned in swimming pools, the age distribution includes two age peaks: one at the very young ages and another at the older ages. Nine of the victims were 5 years old or younger, including six who were 1-year-olds. There were also four victims who were 66 years or older. Only two of these 20 pool drownings occurred on Neighbor Islands (both on Maui); the rest were on O‘ahu.

Many of the victims who drowned in rivers or streams were adolescents or young adults in the age range of 10 to 26 years. Most of these drownings occurred on the Neighbor Islands.

There was a broad age range among victims who drowned in the ocean, but almost all of them (97%) were 18 years of age or older. The locations of these drownings were almost equally divided between O‘ahu and the Neighbor Islands.

The rates of drownings were higher on the Neighbor Islands than on O‘ahu. Whether county-specific rates are compared for (1) all drownings or (2) for specifically saltwater or ocean drownings, the rates on O‘ahu are half the rates in Hawai‘i County as well as three to four times lower than the rates for Kaua‘i County (which were the highest in the state). Rates for Maui County were closer to, but still higher than, the rates for O‘ahu.

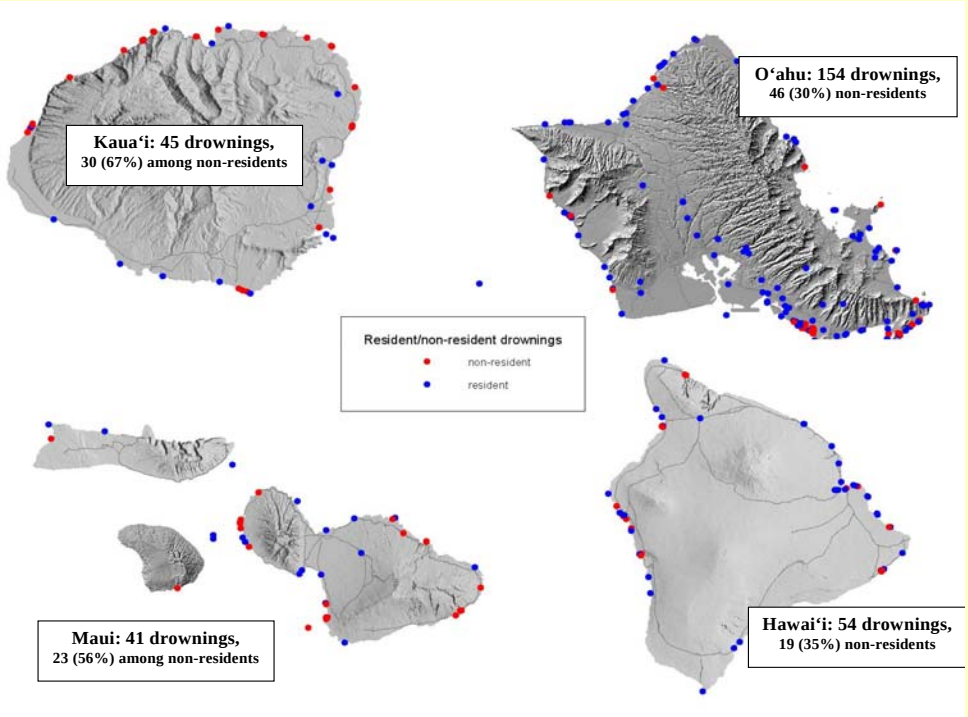


The map on the next page shows the approximate location of the drownings in each county and the residence status of the victims. (Non-resident data are indicated by the red dots, and resident data by the blue.)

About two-thirds (30, or 67%) of the 45 drownings on the island of Kaua‘i were of non-residents. Drownings occurred all around the island, but almost one-third (13, or 29%) were along the Nā Pali coast. Most of these victims were non-residents.

Only 30% of the 154 drownings on O‘ahu were among non-residents. There were high numbers in metropolitan Honolulu, east O‘ahu, and the North Shore. About one-third (14 of 46) of the non-resident victims drowned off the coastal stretch from Ala Moana Beach Park to Kaimana Beach. Another 10 drowned off the eastern tip of the island from Portlock to Makapu‘u.

Drownings in Hawaii, by county and residence of victim, 1998-2002.



More than half (56%) of the victims in Maui County were non-residents, with high numbers in the Mākena and Kā'anapali areas of the island of Maui.

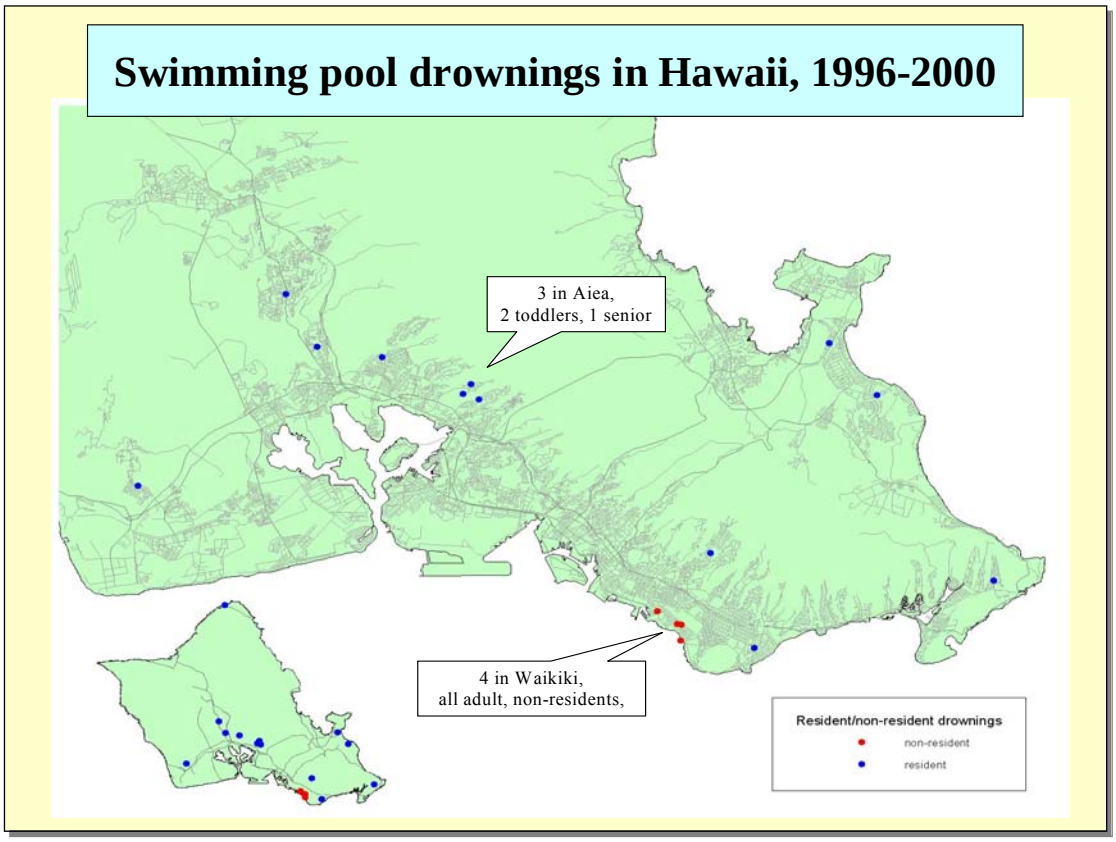
Non-residents comprised only about 35% of the victims who drowned on the island of Hawai'i. Areas with high numbers included Hilo and the Kona Coast, and the Puna district.

Most of the 19 swimming pool drownings occurred in home pools. All but 2 of the 19 were on O'ahu. Most of the victims were unintentionally immersed in the pool, including the seven who were 2 years of age or

Swimming pool drownings in Hawaii, 1996-2000

- **Pool drownings (6%, or 19)**
  - ***Most (12 of 19 deaths) in home pools***
    - ***5 in hotel pools***
  - ***All but 2 on Oahu***
  - ***Half of the victims (10 of 19) had unintentional immersions***
    - ***7 victims 2 years or younger; 3 were 59 years or older***

younger and the three oldest victims. The problem of non-swimmers falling into pools occurs to both the very young and the elderly.

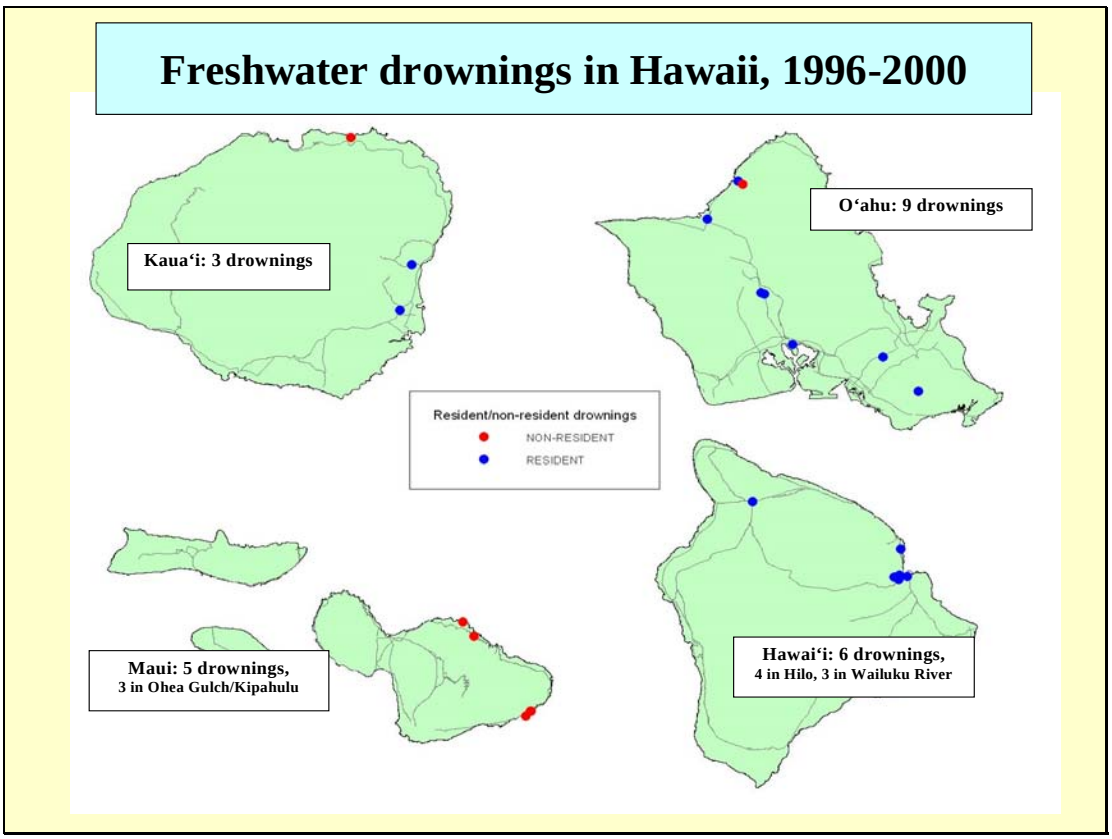


Most of the freshwater drownings were in rivers or streams; two occurred in a pond. There were a disproportionate number on Hawai'i Island and Maui.

Like pool drownings, most of these drownings were the result of unintentional immersions or people falling into the river or stream.

Freshwater drownings in Hawaii, 1996-2000

- **Freshwater drownings (6%, or 23)**
  - ***Most (21) in rivers or streams***
    - ***6 on Big Island; 3 in Wailuku River***
    - ***5 on Maui; 3 in Ohea Gulch/Kipahulu***
  - ***Most victims (10) had unintentional immersions***
    - ***Only 5 were known to be swimming***
      - ***Activity unknown for 7 victims***



This map shows approximate locations of the freshwater drownings. Again, there was a relatively high number (6) on the Big Island, where 4 occurred in the Hilo area and 3 in the Wailuku River. All the victims were residents.

There was also a high number (5) on the island of Maui, where three took place in the southeast area of Ohea Gulch/Kipahulu. All five victims on Maui were non-residents.

There were nine drownings on O'ahu at different locations around the island. Eight of the victims were residents.

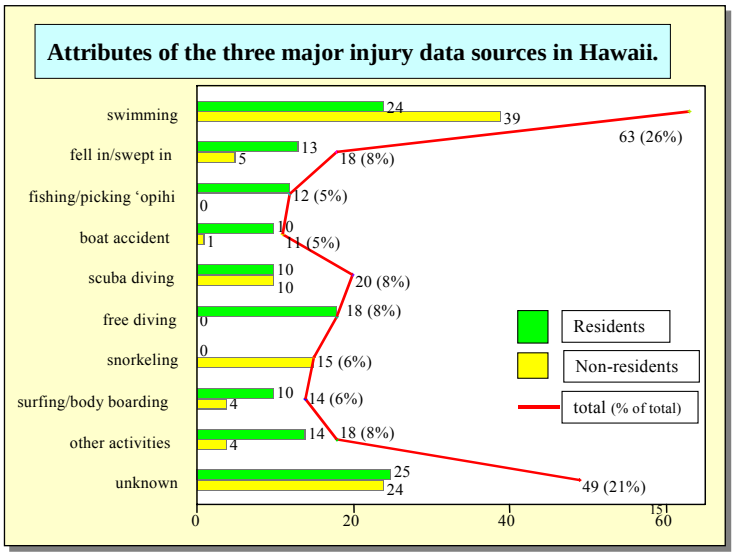
Saltwater drownings in Hawaii, 1996-2000

- **Saltwater drownings (80%, or 238)**
  - ***Various activities***
    - ***26% swimming (two-thirds non-residents)***
    - ***17% had unintentional immersions (85% residents)***
  - ***More than one-third (43%) involved personal factors (Honolulu ME)***
    - ***Most commonly circulatory diseases (21%)***

Saltwater drownings accounted for over three-fourths of all drownings in the

state. The types of activities in which the victims were engaged at the time of the drownings were widely distributed. They included swimming, scuba diving, free diving, and other sports. As with other types of drownings, a significant proportion (17%) was due to unintentional immersion.

Autopsy records of drownings that occurred in Honolulu County were reviewed and the information linked to death certificate data. An important finding from this surveillance was that more than one-third (43%) of all saltwater drownings in Honolulu County were at least partly due to personal factors having little to do with the ocean environment. The most common personal factor was circulatory disease, usually heart attack.



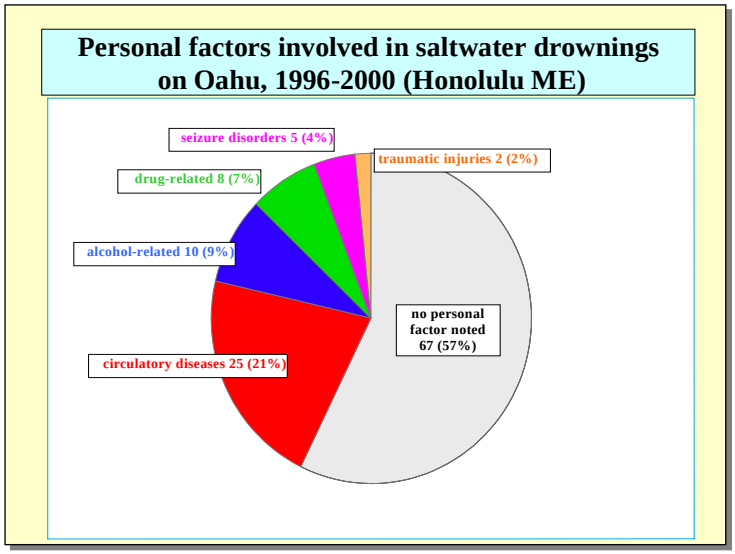
The most common activity engaged in by the 238 victims of saltwater drownings at the time of the incident was swimming, accounting for approximately one quarter (63, or 26%) of the total. Almost two-thirds of these victims (39, or 62%) were non-residents.

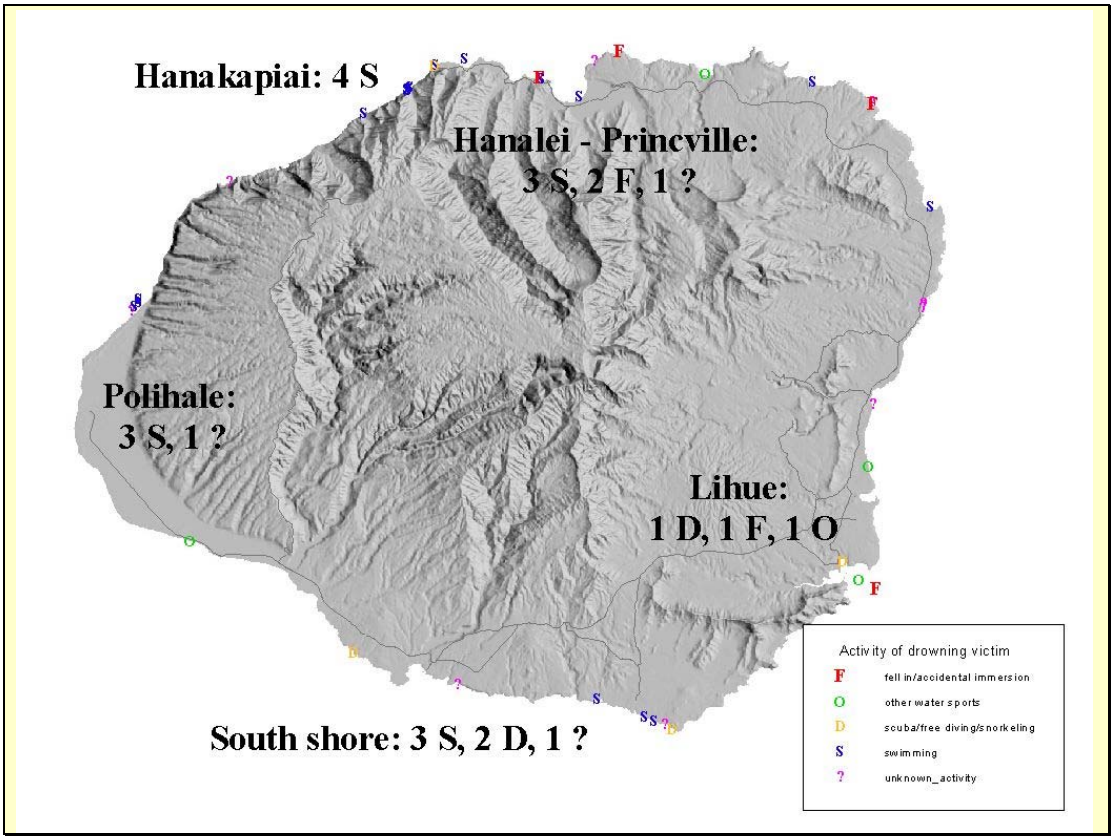
There were 41 drownings resulting from unintentional immersion, where victims included people who fell in or were swept in while fishing or gathering from shore, or who drowned after boat accidents. Nearly all of these victims (35, or 85%) were residents.

The 20 deaths of scuba divers were equally divided between residents and non-residents. All of the 18 victims who drowned while free diving were residents, while all of the 15 snorkelers were non-residents.

Most (24, or 75%) of the victims who were surfing, body boarding or engaged in other water sports were residents. There was a large group of victims (49, or 21%) whose activity at the time of drowning was not documented.

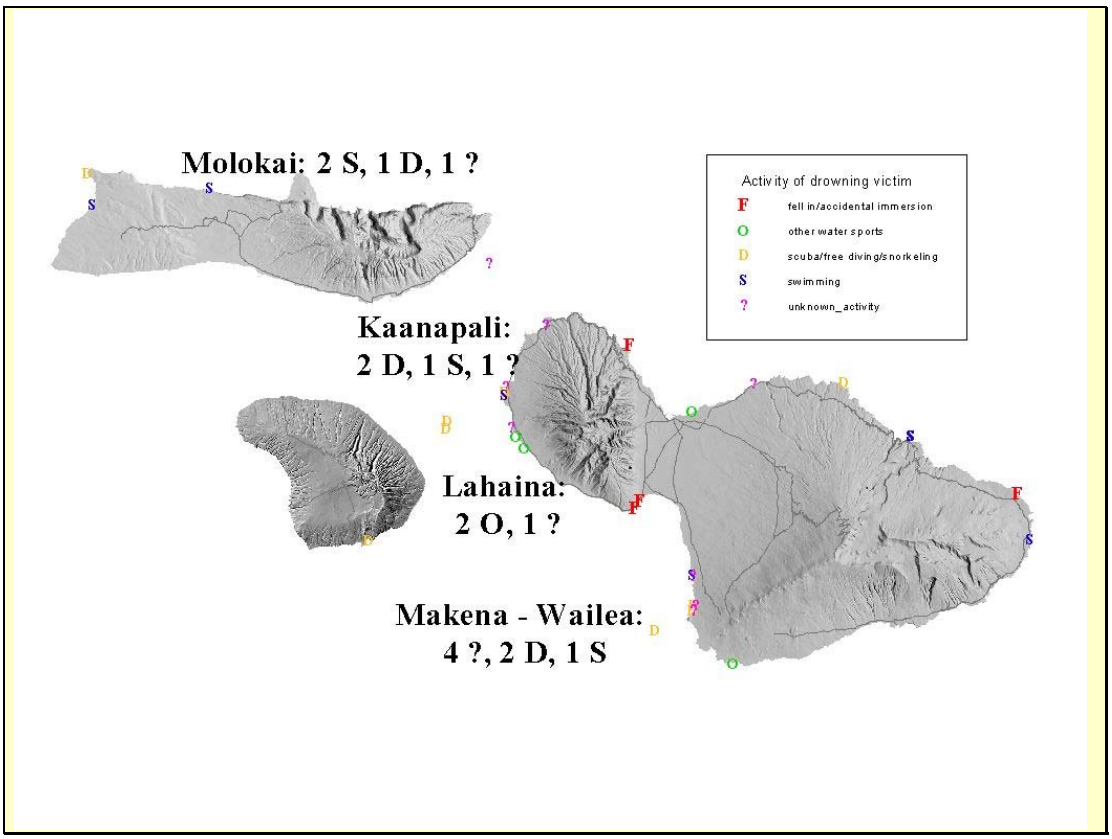
The most common personal factor was circulatory disease, which contributed to 21% of the drownings. Alcohol or illicit drugs were detected in the blood of 16% of the victims. Methamphetamine was the most commonly screened drug. Five of the drownings were related to seizure disorders, and two other victims sustained traumatic injuries which led to their drowning.



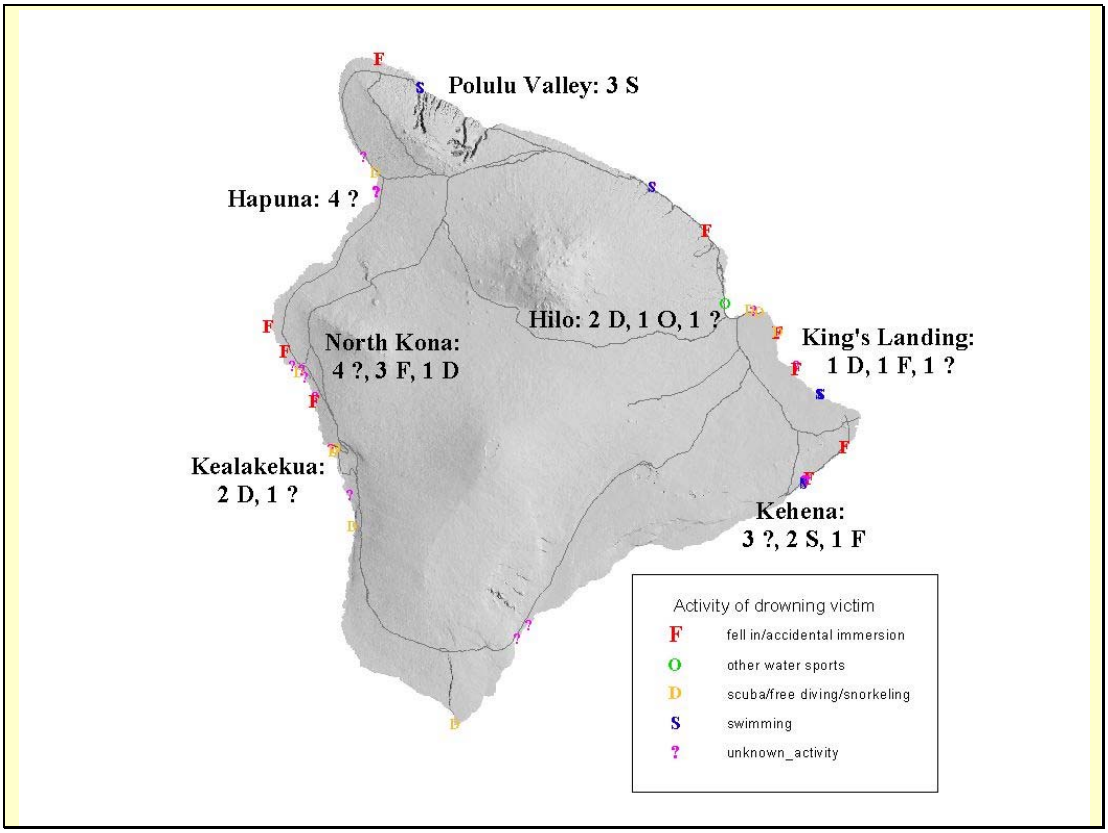


Locations of saltwater drownings on the island of Kauaʻi from 1996 to 2000 have been mapped.

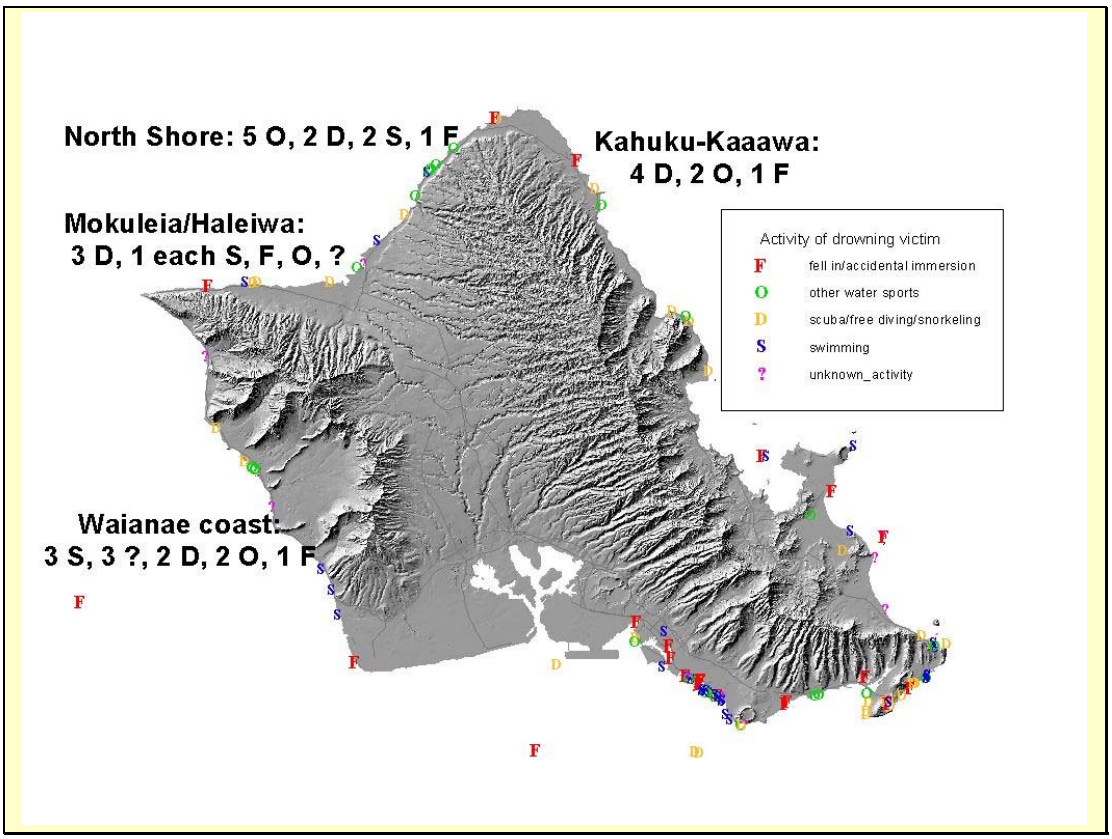
Almost all (10) of the 13 victims who drowned along the Nā Pali Coast of Kauaʻi were swimming at the time of the incident, including four who drowned at Hanakāpīʻai and three at Polihale beach. (One victim was snorkeling, and the activity status for the other two was not known.) There were 3 to 4 drownings each year along Nā Pali, except for 1998, in which there were none. Swimming was generally less frequent of an activity among the remaining 28 victims of saltwater drownings on Kauaʻi.



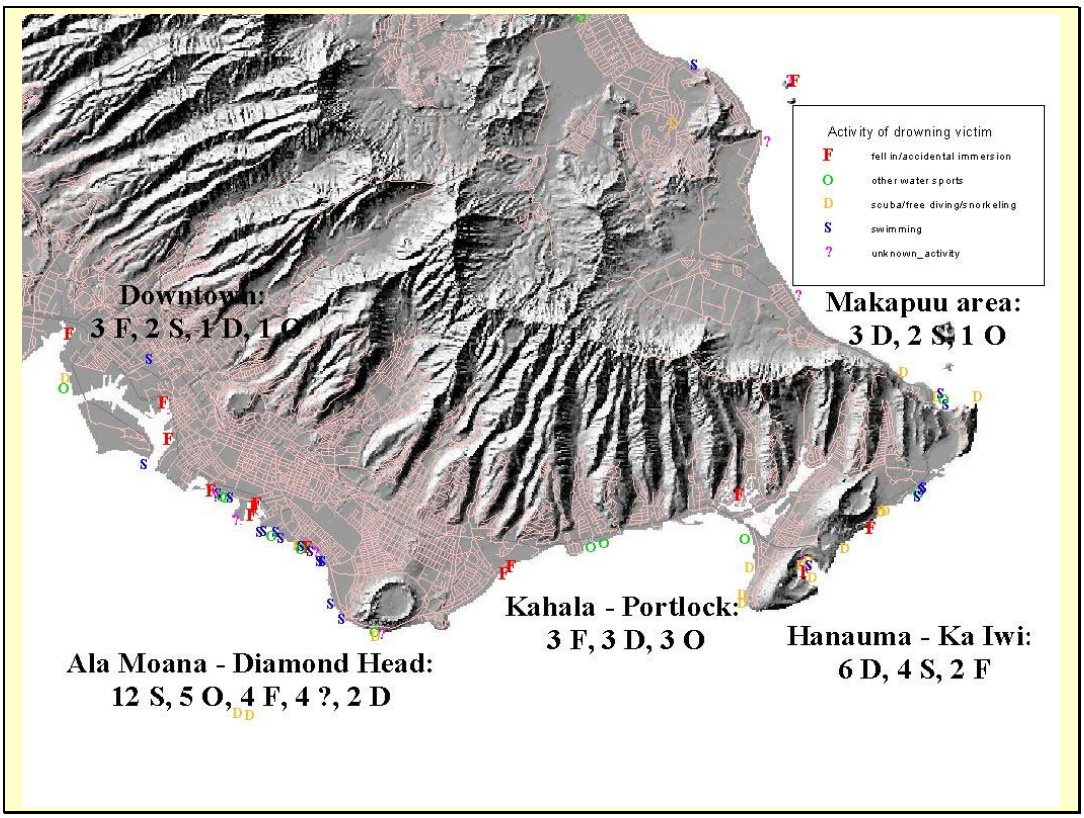
Only 5 (18%) of the 28 saltwater drownings on the island of Maui were among victims who had been swimming at the time of the incident. There were more victims (8) who had been diving, including 3 who were scuba diving off the west coast of the island and 4 who were snorkeling.



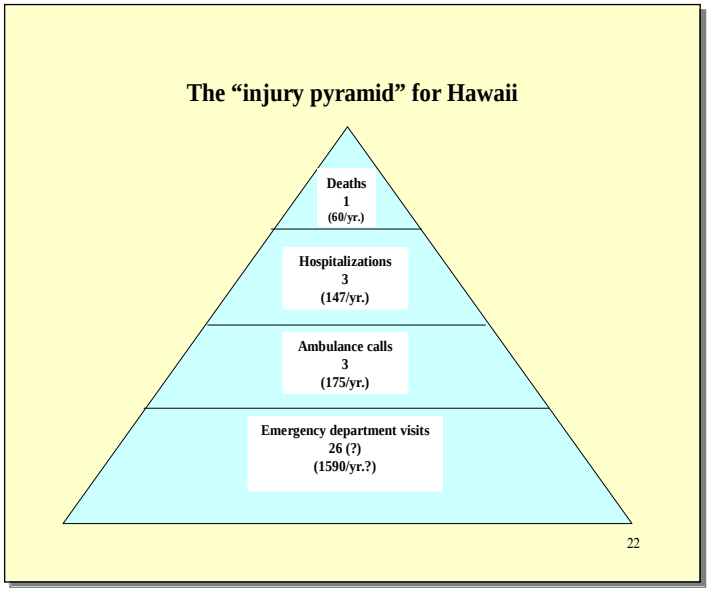
Unfortunately, the activity was not known for 40% (19) of the 47 victims of saltwater drownings on the island of Hawai‘i, the highest such proportion in any county. There were 10 victims unintentionally immersed, 9 who were diving (i.e., 4 free diving, 3 snorkeling, and 2 scuba diving), and 8 others who had been swimming. The drownings due to unintentional immersions or diving were widely dispersed around the island.



Swimming (29 victims) was the single most common activity among the 116 saltwater drowning victims on O‘ahu, but most of the incidents occurred in the Honolulu area (14 drownings) or on the eastern side of the island (6). Relatively few of the drownings outside of the Honolulu area were related to swimming. Half (5) of the 10 drownings which involved surfing or body boarding occurred along the North Shore. (These incidents are denoted by the “O” for “other water sports” on the accompanying map.)



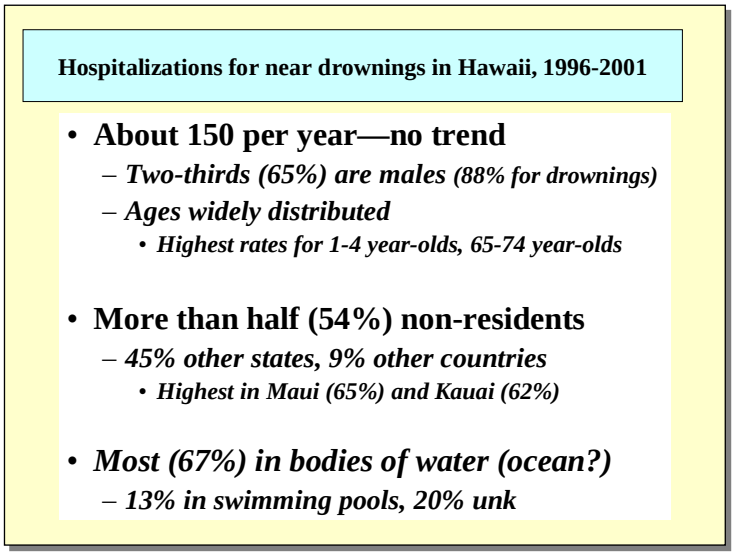
The map (above) shows the saltwater drownings in the Honolulu-to-east O‘ahu section in greater detail.



In the field of injury prevention, there is the concept of the Injury Pyramid. For every death due to drowning, there are three near-drownings requiring hospitalization and perhaps as many as 26 that are treated in emergency departments, of which about 11% are transported via ambulance.

The four most common levels at which injury data may be collected are (1) death, (2) hospitalization, (3) ambulance-attended, and (4) emergency department visit. In Hawai‘i, information on fatal injuries is available through death certificates, data on hospitalizations from the Hawaii Health Information Corporation (which archives all admission records in the state), and Emergency Medical Services (EMS) ambulance reports. These are the three main sources of data used by the Injury Prevention and Control Program, although data on injuries requiring emergency department treatment are currently unavailable.

The next slide describes the main sources of data used in injury prevention, along with their limitations. It's important to be aware of these limitations, since there are some fairly wide gaps in the injury surveillance data.



There are about 150 hospitalizations for near-drownings in Hawai'i each year, but there is no trend over time visible in the annual total. About two-thirds (577, or 65%) of the victims from 1996 to 2000 were males, a much lower ratio than that seen in fatal drownings (88% male). The ages of the victims were widely distributed over the 0 to 90-year range. The highest rates were computed for the 1- to 4-year-old group, and the 65- to 74-year-old group. Rates for males were higher than those for females at every age group, particularly in the 15- to 60-year age range.

More than half (436 of the 822 victims for whom residence was known, or 54%) of the victims were not residents of Hawai‘i; 45% were from other states and 9% were from other countries. The proportion of non-residents was much higher among those

hospitalized in Maui County (64%) and Kaua‘i (62%), compared to Honolulu (38%) and Hawai‘i (28%).

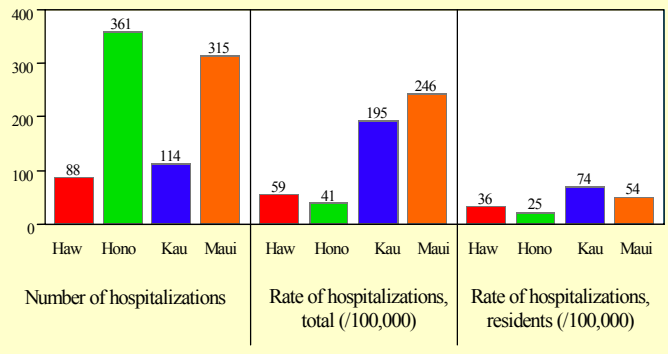
Based on e-coding, about two-thirds (67%) of the incidents were thought to have occurred in bodies of water, most likely the ocean. (This estimate requires significant assumptions based on vague e-code categories, however.) Only 13% of the incidents were noted to have occurred in swimming pools; data were missing for the remaining 20% of cases.

Almost all (94%) of the victims were ultimately discharged to home. About half (438, or 49%) were hospitalized for 1 day or less, 20% were hospitalized for 2 days, 20% for 3 to 7 days, and the remaining 10% for more than 1 week. The average charge for each hospitalization was about $14,100 ($12,000 if two extreme cases are removed). Total charges were therefore nearly $12.5 million, or more than $2 million per year. Hospital charges do not include physician charges, which would roughly double the actual charge.

Hospitalizations for near drownings in Hawaii, 1996-2001 (cont.)

- **Hospital charges about $2 million/year**
  - ***(doubled, counting physician charges)***
- **41% hospitalized in Honolulu County, 36% Maui, 13% Kauai, 10% Hawaii**
  - ***Rates higher on Neighbor Islands***
    - ***Particularly Kauai and Maui counties***

Rates of hospitalizations for near drownings in Hawaii, by county, 1996-2001.



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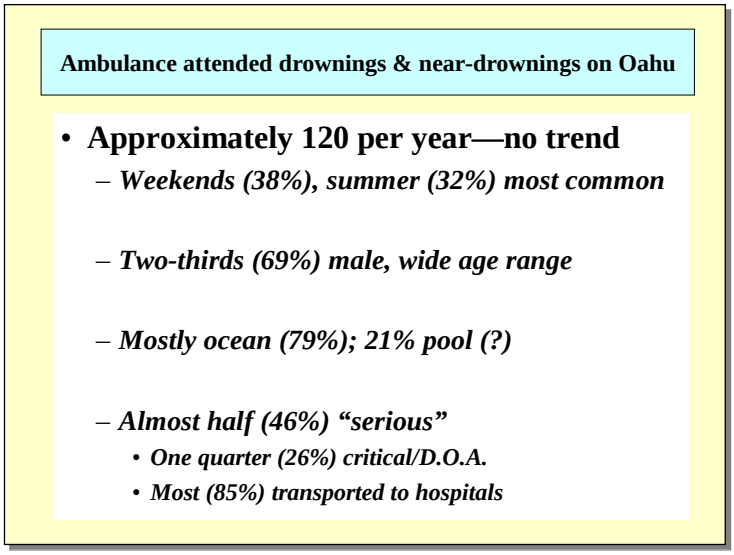
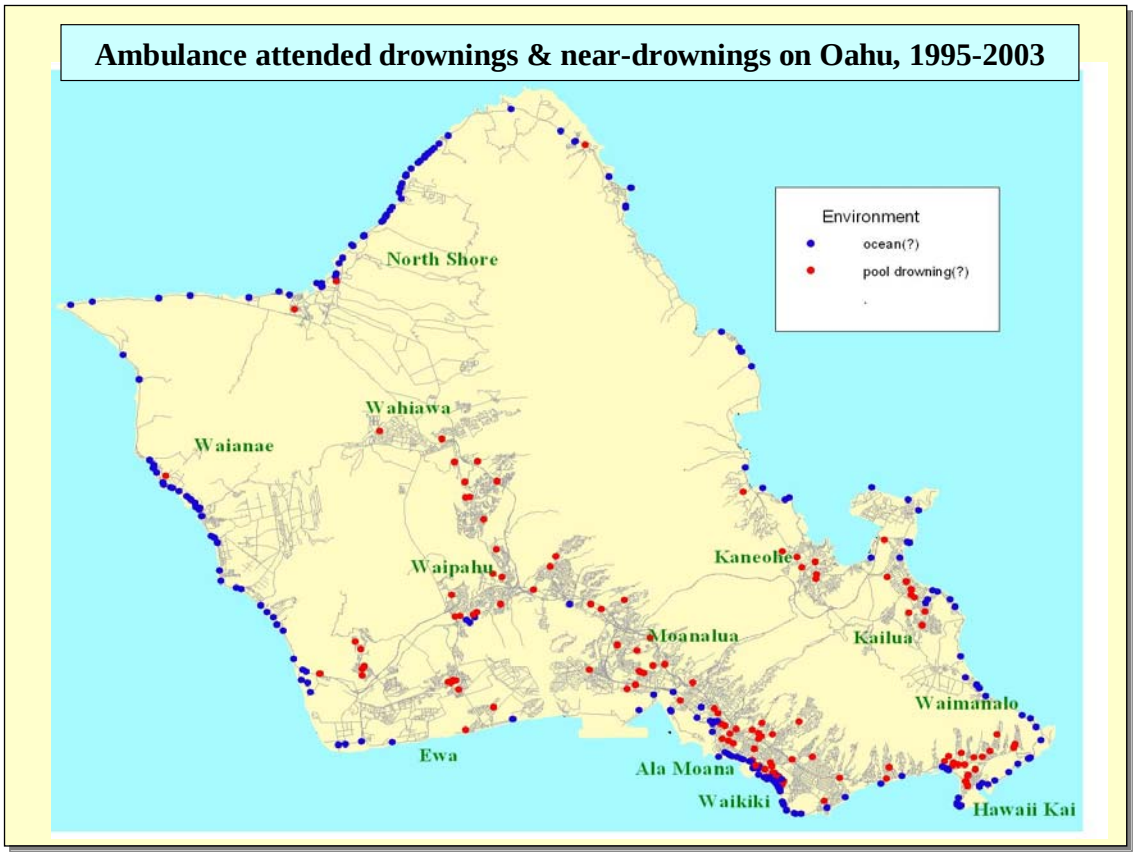
Forty-one percent of the victims were hospitalized in Honolulu County, 36% in Maui County, 13% in Kaua‘i, and 10% on the island of Hawai‘i. When adjusted for the resident population, however, the highest rates of hospitalization were computed

for the Neighbor Islands, particularly Kaua‘i and Maui County which were at least four times higher than the rates for Honolulu. These geographic differences remain even when only state residents are considered, although the magnitude is lower with proportionally more of the Maui and Kaua‘i victims identified as non-residents.



Ambulance personnel attend to about 120 drownings or near-drownings each year on O‘ahu. Weekends and summer months are the most common times. Most of the patients are males, and the age range is broad. Based on dispatch addresses, it is estimated that 79% of the events occur in the ocean and perhaps 21% in swimming pools.

These are serious events; almost half were graded as serious, and over a quarter were critical or dead on arrival (D.O.A.).



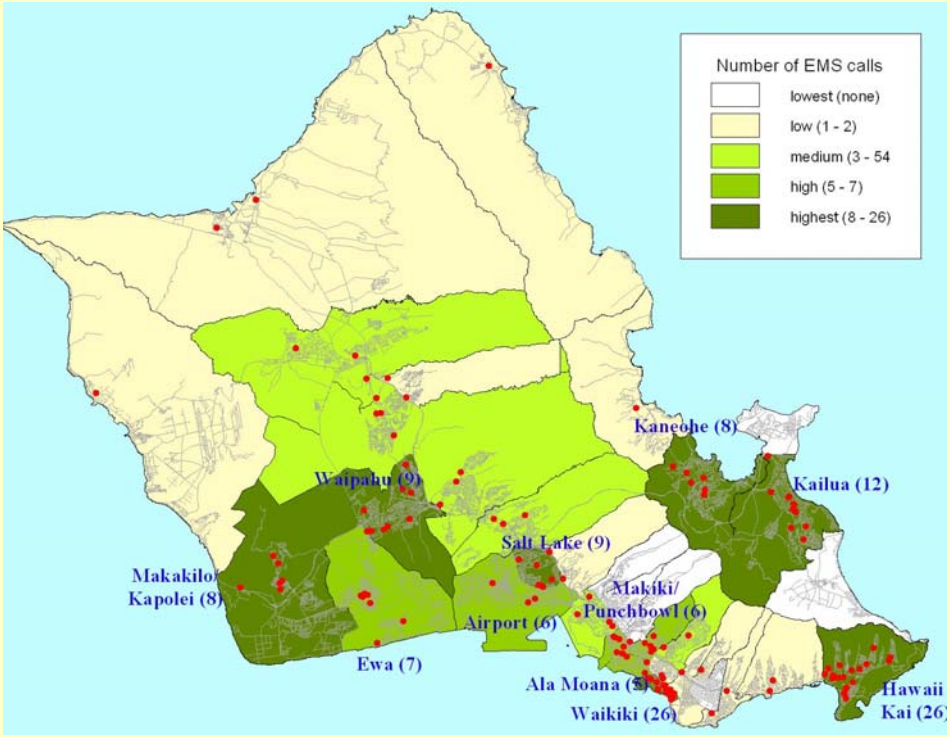
Ambulance attended drownings & near-drownings on Oahu (cont.)

- **Pool drownings & near-drownings**
  - ***Approximately 25/year***
    - ***Half (53%) between May through August***
  - ***Infant to 4 year age group highest risk (43%)***
    - ***Especially 2 and 3 year-olds (27%)***
    - ***Two-thirds (67%) male***
    - ***Most are serious (57%) or critical/D.O.A. (15%)***
    - ***Hawaii Kai (6) and Salt Lake (4) highest***

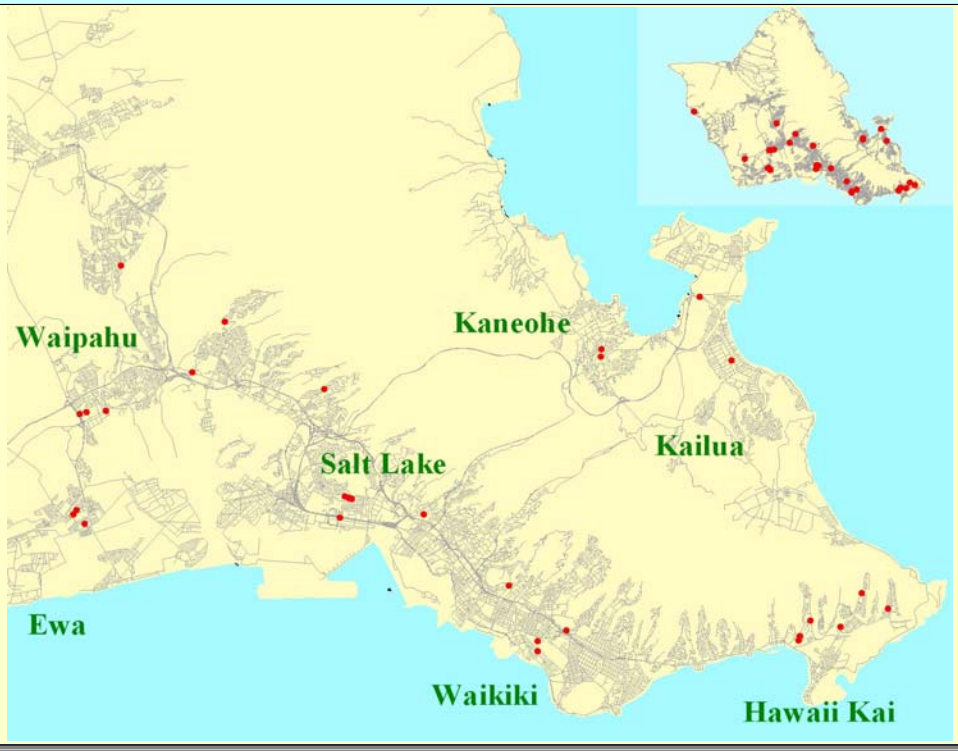
There are an estimated 25 swimming pool drownings and near-drownings on O‘ahu that involve EMS each year. Over half occur during the summer months of May through August.

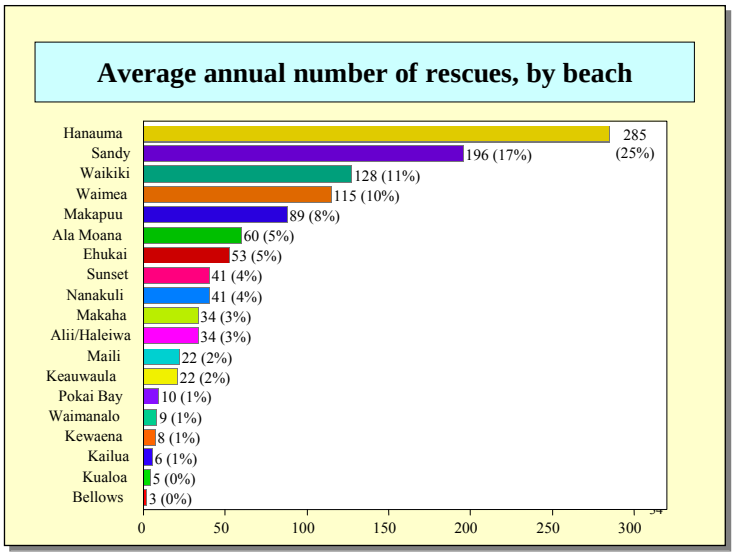
Very young children are at the greatest risk; 43% of the patients were 0 to 4 years of age. Two- and three-year-olds in particular were at the greatest risk. Most of these young patients were males (67%). Most of these events were graded as serious or critical by ambulance personnel. The highest total was seen in Hawai‘i Kai, followed by Salt Lake.

Ambulance attended pool drownings & near-drownings on Oahu, 1995-2003



Ambulance attended pool drownings & near-drownings among children 0-4 years

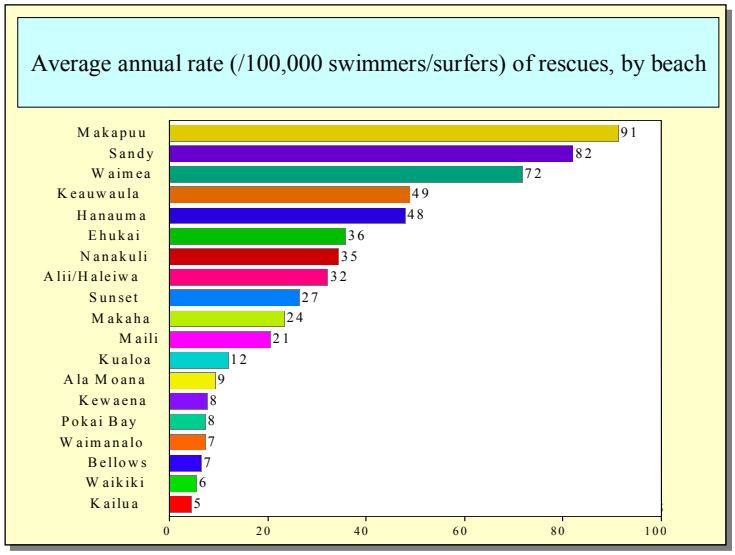




Of the 19 beaches manned by lifeguards, Hanauma reports the highest average annual number of rescues, 285, which is 25% of the total for all of O‘ahu.

Other beaches with high totals are Sandy, with around 200 rescues per year, Waikīkī, Waimea, and Makapu‘u. These five beaches report 71% of all the rescues in the county.

By using rates to adjust for the number of people in the water, we can compare how dangerous beaches are, relative to each other.



For example, the previous slide showed Waikīkī with the third highest total number of rescues each year. Few, however, would consider Waikīkī to be a dangerous beach. The reason for the large number of rescues there is because of the large crowds. Lifeguards estimate an average of 2.2 million people in the waters off Waikīkī each year. Comparisons of rescue rates, however, show that Waikīkī is one of the safest beaches on the island (6 rescues per 100,000 individuals in the water).

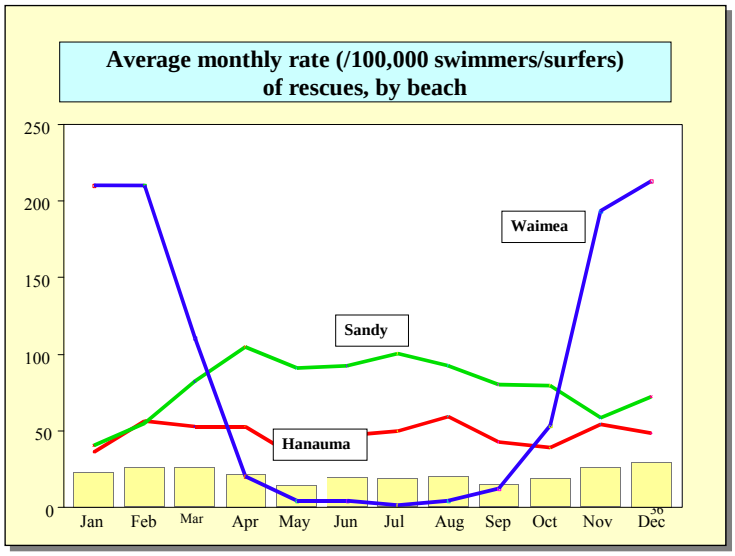
The most dangerous beaches are Makapu‘u, Sandy, and Waimea, all with rescue rates at least 10 times greater than the rate for Waikīkī.

Keauwaula also has a high rate, but that is based on only about 20 total rescues each year.

Hanauma has the fifth highest rate, in addition to having the highest total number of rescues in the county.

Hanauma, Sandy, Makapu‘u and Waimea were all in the “top five,” with respect to both the number and rate of rescue; they are the most dangerous beaches in both absolute and relative terms.

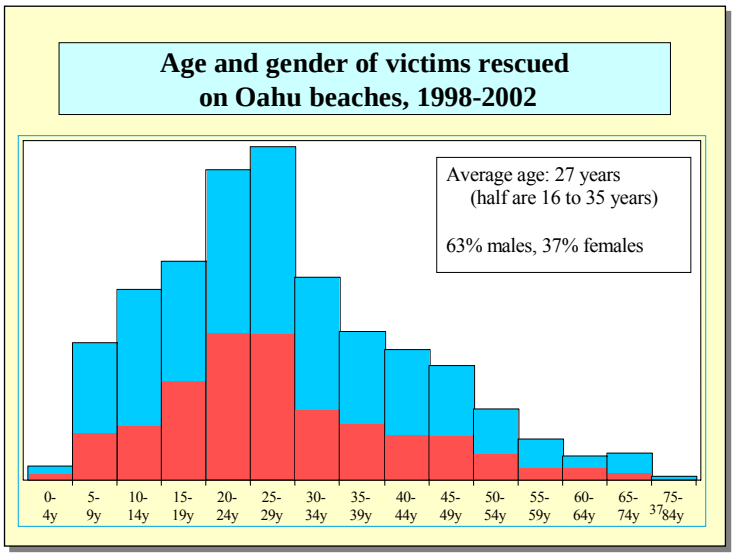
The risk at a given beach can vary widely, depending on the ocean conditions. An examination of rescue rates by month for Hanauma, Sandy and Waimea illustrate this.



In the graph, the yellow bars represent the average monthly rate of rescue at the county level. The rate varies little over a year. With respect to individual beaches, however, there may be great differences in the rate, depending on the time of year. The best example is Waimea Bay. During the winter months of November through February, Waimea has demonstrates the highest rate in the county, about 10 times higher than the overall average rate. In the summer months, however, it has the lowest rates as do the other North Shore beaches.

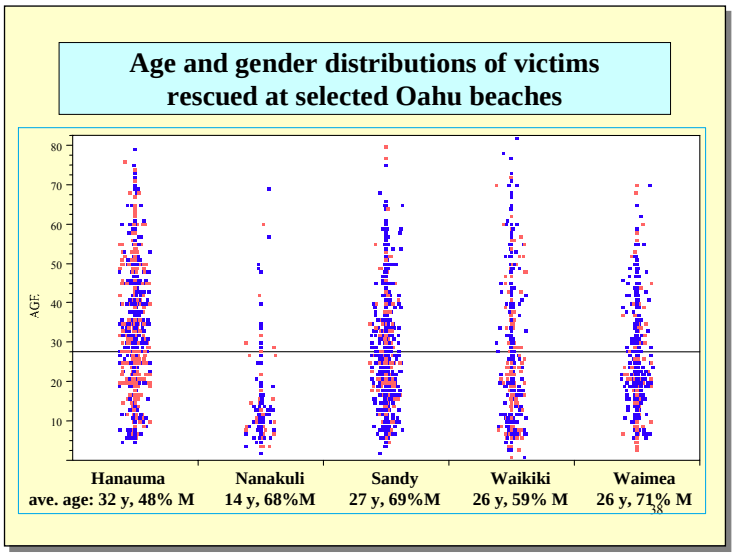
Sandy demonstrates a different pattern: the lowest rates are experienced in the winter months, peaking in April, May, and the summer months.

Finally, there are beaches like Hanauma where the rate does not change much at all over the year, remaining relatively high year-round.



Rescues take place for people of all ages; from 1998 to 2002, the ages of those rescued ranged from 1 to 87 years. The average age was 27 years.

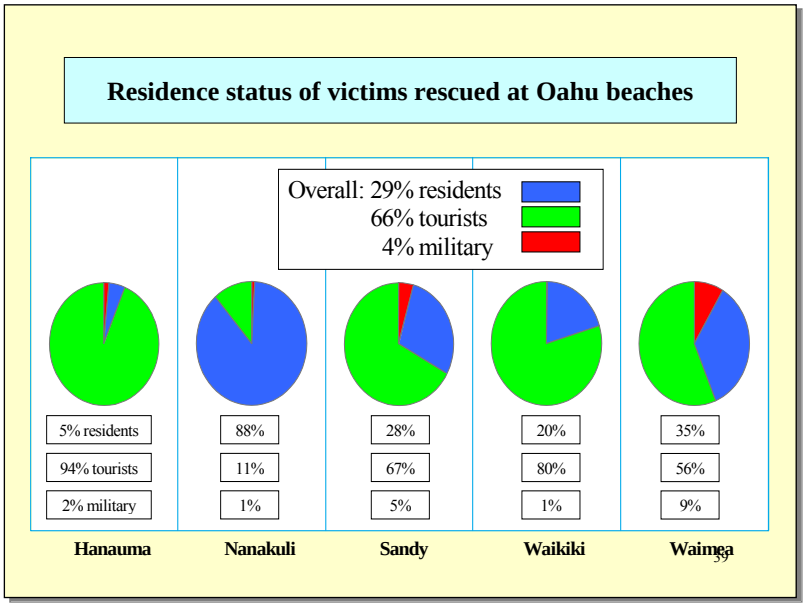
The males are shown in blue shading and the females in red. The age distributions by gender are similar. Overall, 63% of the victims were males, outnumbering females by a ratio of 2-to-1.



Demographics may vary widely, depending on the beach. The graph shows the age distribution of victims rescued at Hanauma, Nānākuli, Sandy, Waikīkī, and Waimea. Age is indicated on the vertical axis. Blue dots represent males and red dots represent females. The solid line in the graph shows that the average age is 27 years.

Victims at Nānākuli were extremely young, compared to victims at other beaches. The average victim age there was 14 years. At Hanauma, the victims were generally much older with an average age of 32 years. The age distribution for Hanauma shows high numbers of victims in their 40's and 50's, which would be unusual at Nānākuli. The victim age distributions at Sandy, Waikīkī and Waimea were similar, where the average age was 26 to 27 years.

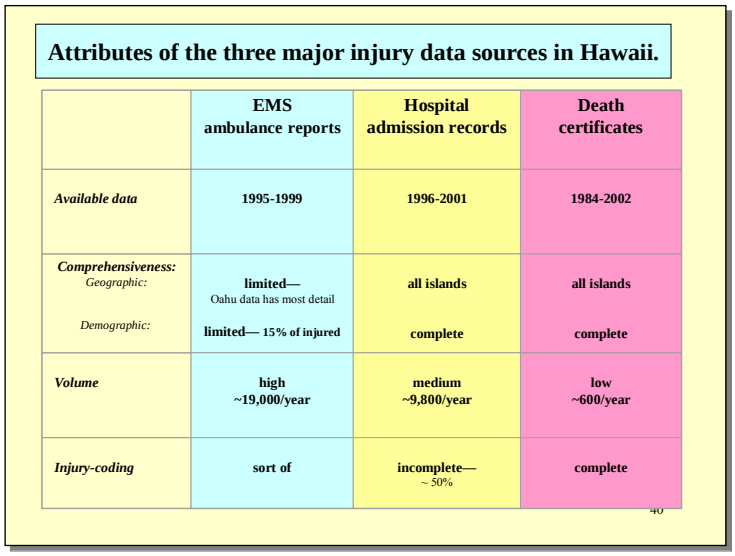
Victim gender also differs somewhat by beach. Overall, about two-thirds (63%) of the victims were males, but the gender ratio at Hanauma is 50:50.



For the county as a whole, most of the victims were tourists. Two-thirds (66%) of the victims were tourists, another 29% were residents, and a small proportion (4%) were military. About one quarter of the tourists were from Japan.

Like age and gender, residence status can differ widely across individual beaches. These pie charts show the residence status of the victims rescued at Hanauma, Nānākuli, Sandy, Waikīkī, and Waimea. The blue shading indicates the resident data, the green shading represents the tourists, and the red shading indicates the military. At Hanauma, 94% of the victims were tourists, but at Nānākuli, 88% were locals. The distribution at Sandy matched that for the county; about two-thirds were tourists. Victims at Waikīkī included about 80% tourists, while at Waimea, there were relatively high proportions of locals and military among those rescued.

The slide summarizes the characteristics of the three main sources of injury data in Hawaii: EMS ambulance reports, hospital admission records, and death certificates.



Attributes of the three major injury data sources in Hawaii.

	EMS ambulance reports	Hospital admission records	Death certificates
Available data	1995-1999	1996-2001	1984-2002
Comprehensiveness: *Geographic:*	limited— Oahu data has most detail	all islands	all islands
Demographic:	limited— 15% of injured	complete	complete
Volume	high ~19,000/year	medium ~9,800/year	low ~600/year
Injury-coding	sort of	incomplete— ~ 50%	complete

40

There are currently six years of data on hospital admissions and four years of ambulance reports. The longest-standing data source is death certificates which have been computerized since 1984. Ambulance data have been updated to 1999 for the Neighbor Islands, but due to the new computer-aided dispatch system instituted on O‘ahu in 1999, it is no longer possible to identify injury-related calls with the same degree of accuracy as during the 1995-1998 period. Hospitalization data are provided by the Hawai‘i Health Information Corporation, and death certificates are archived at the Department of Health.

Ambulance records are the least comprehensive data source; the quality of injury data is better on O‘ahu than on the Neighbor Islands, at least up until 1999. In short, dispatchers on O‘ahu used to record more detail on the causes of injuries than did dispatchers on the Neighbor Islands. Ambulance data is also least comprehensive in describing the basic demography of injuries in Hawai‘i, as not everyone utilizes ambulance services when they are injured. We estimate that only about 15% of the patients treated for injuries in emergency departments are transported by ambulance.

Data on injury-related hospitalizations and deaths is comprehensive for the state, as HHIC collects admission data from all acute care hospitals in the state. However, there are deficiencies in the coding of this data. Data from death certificates is the most complete in that the system captures all fatal injury data and all the records are injury-coded. In contrast to non-fatal injuries, however, there are relatively fewer injury deaths.

Since not everyone who receives ambulance services is hospitalized, there are many more ambulance records than hospital records. There are differences between these data sources, however, with respect to the extent of information they collect on injuries. O‘ahu ambulance records may be categorized by 17 different injury categories, but these are not the recommended standard categories. Ambulance data does not distinguish suicidal injuries from the non-suicidal. (Only four categories are available from Neighbor Island EMS records.) Both hospital records and death certificates are preferable in comparison, because they use the standard injury E-coding scheme. Although, injury E-coding is complete for fatal injuries, only about half of hospital admission records contain an injury E-code. Without these codes, it is not possible to determine the cause of the injury.